

Report on the country between  
Lake Winnipeg and Hudson's Bay  
1878

by  
Robert Bell, M.D., C.M., F.G.S.

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**GEOLOGICAL SURVEY OF CANADA.**

ALFRED R. C. SELWYN, F.R.S., F.G.S., DIRECTOR.

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**REPORT**

ON THE

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AND

**HUDSON'S BAY,**

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MONTREAL, May 5th, 1879.

ALFRED R. C. SELWYN, F.R.S., F.G.S.,

*Director of the Geological Survey.*

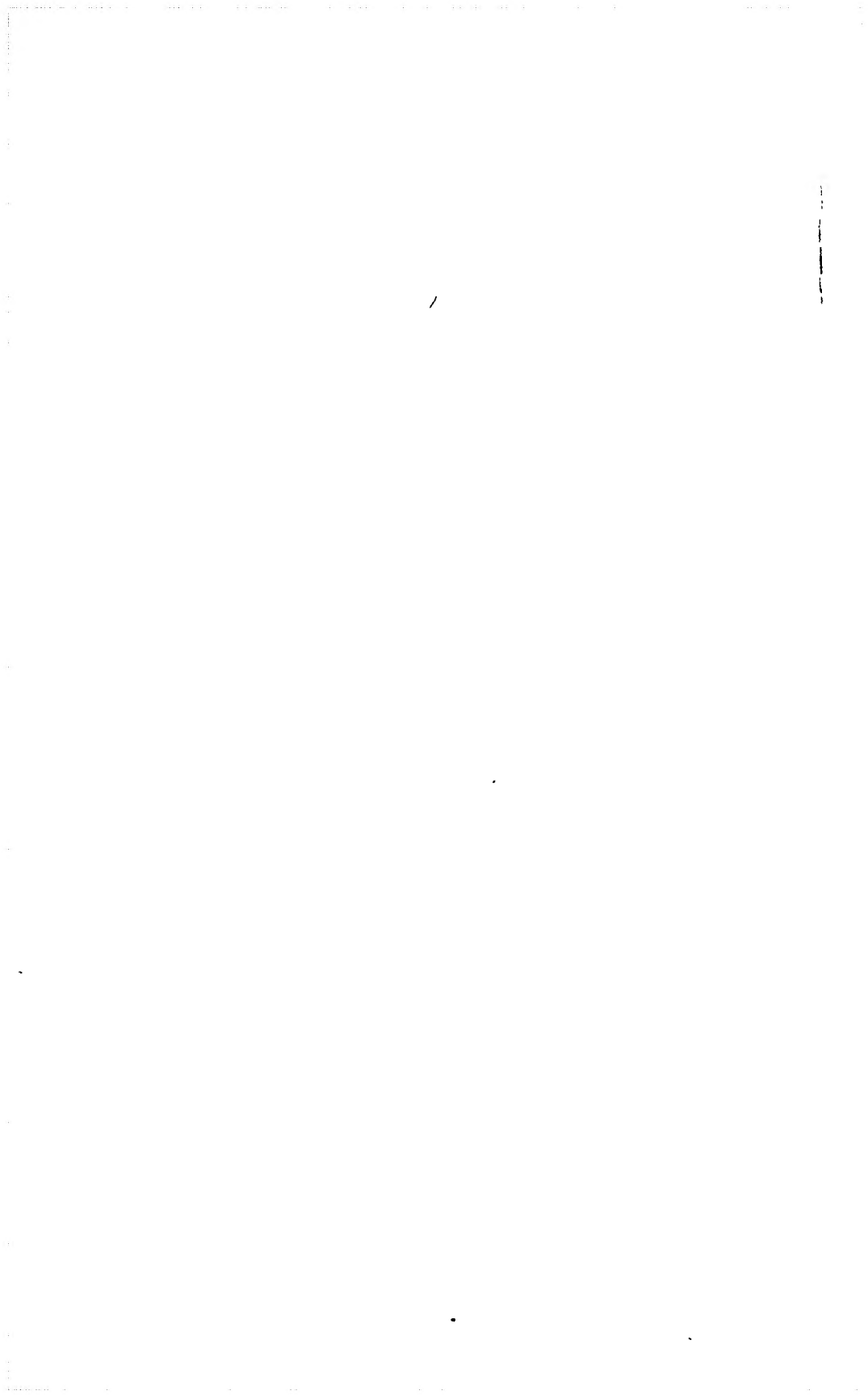
SIR,—Herewith I beg to hand you my report and maps, shewing the results of the explorations and surveys which I made last season on Lake Winnipeg and between that lake and Hudson's Bay, in conformity with your instructions.

I have the honor to be,

Sir,

Your obedient servant,

ROBERT BELL.



REPORT  
ON THE  
COUNTRY BETWEEN LAKE WINNIPEG  
AND  
HUDSON'S BAY  
BY  
ROBERT BELL, M.D., C.M., F.G.S., C.E.

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In order to reach my field of operations I proceeded to Winnipeg, *Journey out.* which I reached on the 14th June. On the 15th I went to Lower Fort Garry to join the Hudson's Bay Company's steamer "Colville," by which Mr. Grahame, the Chief Commissioner, had kindly allowed me to take passage, free of charge, through a part of Lake Winnipeg. The steamer left her wooding station near the mouth of Red River on the 19th, and on the 20th reached George's Island, off Poplar Point, on the East shore of the lake. Here I left her, and on the 21st sailed in a "York boat," from Poplar Point, and reached Norway House in the *Norway House.* afternoon, or on the third day after leaving Red River. Norway House, which is situated on the Nelson River, twenty miles below its efflux from Lake Winnipeg, was made my headquarters for the season. Here Mr. Roderick Ross, the gentleman in charge for the Hudson's Bay Company, gave me free storage for my supplies all summer. I was also indebted to the owners of this post, and of Lower Fort Garry, Beren's River, Oxford House and York Factory for much hospitality as well as for valuable and at all times readily accorded assistance in my labors. My best thanks are likewise due to the Venerable Archdeacon Kirkby, of York Factory, for geological specimens collected about Fort Churchill, and also to the Rev. Mr. Rattan, of Rossville mission, for a sketch-map of a canoe-route between the Nelson and Churchill rivers.

The following topographical surveys and explorations, which were *Surveys made.*



accomplished without the aid of an assistant, were additional to the purely geological work of the season :

- (1.) Track-survey from Lake Winnipeg to Norway House, and of Groat and Little Playgreen Lakes.
- (2.) Track-survey of the boat-route from Norway House, to York Factory, by way of Oxford House and Knee Lakes.
- (3.) Survey of Haye's River in the vicinity of York Factory.
- (4.) Track-survey of Nelson River from the sea for about 90 miles up.
- (5.) Track-survey of Nelson River, downward, for a distance of 180 miles, from the outlet of Lake Winnipeg.
- (6.) Track-survey of the western channel of Nelson River, from Great Playgreen Lake to Cross Lake, including part of the latter.
- (7.) Track-survey of the east shore of Lake Winnipeg, from the outlet to Dog's Head.
- (8.) Track-survey of the Islands and the west shore of Lake Winnipeg from Dog's Head to Drunken River.

**Maps.**

The above work is all laid down on a scale of four miles to one inch, with the exception of the plan of the survey in the vicinity of York Factory, which is on a scale of one mile to an inch. The two accompanying maps, in the compilation of which I was assisted by Mr. George Andrews and Mr. A. S. Cochrane, represent these surveys on a scale of eight miles to one inch. On the map showing Lake Winnipeg, the outline of the entire sheet of water has been completed from other authorities which are acknowledged in the title of the map itself.

**Observations.**

Although the geology of the country was the main object of the investigations, yet care was taken constantly to make notes in regard to the soil, timber, and climate of the region explored, and also respecting the fishes, birds and mammals inhabiting it. A considerable amount of general information was likewise collected, the variation of the magnetic needle was ascertained in some places, and the latitude of York Factory was determined by numerous observations to be  $57^{\circ}, 1', 40''$ . Thirty photographs were taken illustrating the character of the country, or shewing some of the more interesting points visited. The height of falls or rapids in the rivers was generally determined by the aneroid barometer, which was also used to find that of hills, banks, &c.

**The Hudson's Bay route.**

The question of opening communication between the North West Territories and Hudson's Bay was always kept in mind and observations were constantly made in reference to it. A special report on this subject has already been submitted.

The rocks of the greater part of the area examined consist of Lau-



rentian gneiss, having a general uniformity of character and presenting little of special interest. The unaltered palæozoic rocks, which form a border along the south-western side of Hudson's Bay, probably extend Geology. about 100 miles inland in the valleys of the Nelson and Hill Rivers, but they are seldom exposed at the surface. One trough of Huronian rocks of considerable extent was found in the region explored, and this will be described separately, while the other geological observations will be included in a general description of each of the foregoing divisions of the season's operations, and in order to condense this part of the subject as much as possible, for facility of reference, I shall give lists shewing briefly the character of the gneiss, as well as its dip and strike, in a sufficient number of localities along each route followed, to serve for all practical purposes.

#### 1.—LAKE WINNIPEG TO NORWAY HOUSE.

The outlet of Lake Winnipeg is situated about fifty miles south-eastward from the northern extremity of the lake. After flowing for four miles through a channel averaging over a mile in width, its waters enter Great Playgreen Lake, the main body of which is four miles in length, and is separated from Lake Winnipeg by a level peninsula of clay and sand, four miles in width, called Mossy Point. The Nelson River leaves Great Playgreen Lake by two channels, which unite again in Cross Lake, having formed an island between them, fifty-three miles in length, and twenty-one miles in width. As this island has as yet received no name, I propose to call it Ross' Island, Ross' Island. in honor of Mr. Roderick Ross of Norway House. The mission village of Rossville, on Little Playgreen Lake, is named after this gentleman's father, who was previously in charge of Norway House.

Following the eastern channel, which is also sometimes called Sea River, the stream leaves Great Playgreen Lake by several branches, which all reunite in Little Playgreen Lake. Norway House is situated on the south shore of this lake where one of these branches falls into it, at a distance of twenty miles from Lake Winnipeg. A former post of the Hudson's Bay Company bearing this name was built on the extremity of Mossy Point, at the outlet of Winnipeg, but it has long since disappeared and the site is now overgrown with trees. Site of Norway House.

#### 2.—BOAT-ROUTE FROM NORWAY HOUSE TO YORK FACTORY.

The travelled boat-route from Norway House to York Factory does not follow the Nelson River (except for a short distance below the former) but a series of lakes and streams lying to the southward of it. The distance between these posts in a straight line is 301 miles by my Route to York Factory.

- map. Lake Winnipeg has been ascertained by the engineers of the Canadian Pacific Railway to be 710 feet above the sea. Notwithstanding this considerable amount of fall, in going from Norway House to York Factory, the difficulties of boat-navigation in descending are not great, but are more serious in returning. In the downward journey it is necessary to haul the boat over dry ground only three times, namely, at the water-shed of the Echimamish, the Robinson Portage and the Trout Fall. These portages measure 28, 1315 and 24 yards respectively.
- Portages.** All the other rapids are run by York boats, and mostly with a full cargo, but at some of them, more or less of the load requires to be carried past by land. In the upward journey there are in all about twenty demi-charges, or hauling places, and in addition to the three complete portages which require to be made in going down, there is a fourth, the Island Portage, about forty yards in length.
- East channel.** The boat-route leaves the east channel of the Nelson River twenty-five miles below Norway House, and turns up a small, swampy and marshy stream called Echimamish. In the interval the river is full of islands, and would average about a mile in width, including them. The shores are rather low, but not often swampy. The banks consists of a light-colored clay, with gneiss frequently appearing underneath it, and forming the points and smaller islands. The timber consists of spruce, tamarack, Banksian pine, white birch, aspen, balm of Gilead and willows, with a little balsam fir.
- Sea-river Fall.** A chute, with a descent of about four feet, called Sea-river Fall, occurs in the east channel at seventeen miles below Norway House, or thirty-seven from Lake Winnipeg. Loaded boats run down this chute, but it is necessary to unload and track them up the current.
- Echimamish.** The Cree word "Echimamish" signifies a channel in which the water flows each way. Its course is eastward, and at twenty-eight miles in a straight line from the east channel, we come to an abrupt termination of the western part, at a low rock called the Painted Stone, twenty-eight yards in width, which forms the watershed of the channel. Hairy Lake and two dams, with a rise of about one foot at each, are passed in the above interval. The boats are unloaded and hauled over the little watershed, and launched into what is regarded as a continuation of the same channel. The White-water River, which discharges Little Lake Winnipeg, joins the eastern Echimamish on the south side, at seven miles from the watershed. From this point to Oxford Lake, the stream having no recognised name, I propose to call it Franklin's River, after the late Sir John Franklin, who had a narrow escape from drowning in it, near the White-water, in 1819.
- Watershed.** Around Rainy Lake, and on either side of the valley of the Echimamish, low domes of rock occur occasionally near the route, and ridges





*at Robinson's Mill Co. Montreal.*

HAULING A YORK BOAT OVER THE ROBINSON PORTAGE.

From Photo. by R. Bell.

which appear to rise to a height of seventy or eighty feet, are seen in some places at a distance of two or three miles back. The Echimaish cuts off a small border along the southern edge of the Huronian trough, which will be described further on; but from the confluence of the White-water, gneiss was the only rock observed along Franklin's River all the way to Oxford Lake. Franklin's River flows successively through Robinson's, Pine and Windy Lakes. Robinson Portage, the most formidable one on the whole route, occurs at the foot of the lake of the same name. The carrying-trail, which is as wide and smooth as a good waggon road, passes over the light grey clay soil which prevails everywhere in this part of the country. The descent in Franklin's River, between the extremities of the trail, was ascertained by the aneroid barometer to be forty-five feet.

Robinson  
Portage.

A swampy lake, without any name, extends for some miles eastward from the foot of Robinson Portage. Seven miles below this portage the river enters a narrow and nearly straight ravine, with walls of gneiss from thirty to seventy feet high, through which it flows for a distance of seven miles to Pine Lake, two rapids occurring in the interval. The south side of Pine lake is bordered by small hills, but to the north-eastward a low tract extends all the way to Windy Lake, around which the country has a slightly undulating aspect. From this lake the river runs north-west, or at right angles to its usual course, and at the end of four miles falls into the head of a marsh on the level of Oxford Lake. Here there is a chute called Wapinaipinis, or the Angling Place, with a descent of about six feet. The marsh referred to opens by a narrow strait into the south-western arm of Oxford Lake.

Oxford Lake runs north-east and south-west, and has a length of Oxford Lake. about thirty miles, with a maximum breadth of eight or nine miles. It contains many islands, and is much subdivided by long points. With the exception of the south-western arm, it is situated entirely within the Huronian trough, and the rocks around it will be described in connection with this basin. Oxford House, a post of the Hudson's Bay Company, is situated on a rising peninsula formed of light grey clay, at the north-eastern extremity of the lake. This lake is also called Holey Lake, or, more properly, Deep-hole Lake, from a small conical hole on the north side, one mile west of Oxford House, which, according to the Indian belief, has no bottom, but is in reality only sixty feet deep. The extension of the lake beyond Oxford House is called Back Lake.

From Back Lake the water passes, by Trout River, which runs Trout River. south-east, to the head of Knee Lake—the distance, in a straight line, being eleven miles.

**Knee Lake.** Knee Lake has a total length of forty miles. It consists of two principal expansions, each running north-east and south-west, connected together about midway between the inlet and outlet by a narrower portion, about nine miles in length, running north and south. The lower part is the widest, and has a maximum breadth of about six miles. The whole lake is studded with islands, but they are particularly numerous in the central part, which is a closely-crowded archipelago. This lake and Trout River lie wholly within the Huronian trough already referred to. A few small hills are seen at the head of the lake and at some other localities near its shores, but, with these exceptions, the country presents all around a low and horizontal outline. The soil consists principally of light grey clay and brown gravelly loam, but near the lake, on the north-west side of the lower expansion, much of it is sandy. The timber on this shore has been burnt within a recent period, but elsewhere it is green and of vigorous growth. Wolverine River, which forms part of the canoe-route to God's Lake, enters the north-eastern extremity of the upper expansion. It may be mentioned that this large lake discharges by the Shamattawa River, and not into Knee Lake, as represented on sketch-maps.

**God's Lake.**

**Jack River** Knee Lake discharges at its north-east extremity by Jack River into Swampy Lake. Jack River runs north-eastward, and has a length of ten miles, in a straight line. It has a considerable descent in the lower half of its course, the rapids being over ledges of Laurentian gneiss and mica-schist, or boulders of the same rocks.

**Swampy Lake.** Swampy Lake is a narrow strip of water ten miles long, and has the same north-east course as the river above and below it. Its name is derived from a point composed of peat on the north-west side, about half way down. The surrounding country is low, but not apparently swampy. Around the upper part of the lake the rocks consist of dark-colored mica-schist, with veins and masses of coarse granite. This is the last lake on the route.

From Swampy Lake to York Factory the river curves regularly round from a north-easterly to a nearly northerly course. It is called Hill River as far as the junction of Fox's River, when it becomes the Steel River to its confluence with the Shamattawa, from which the united stream all the way to the sea is called Hayes' River.

**Labyrinth of islands.** Leaving Swampy Lake, Hill River, for nineteen miles, flows through a labyrinth of small islands. Although the banks are low, there is a very considerable and tolerably regular descent in this distance, the river being broken by a great number of rapids, all of which, however, may be run by boats. The bed of the river, and the innumerable small islands, are mostly formed of angular blocks and fragments of gneiss.

This rock occurs *in situ* at some of the rapids. It is mostly very micaceous. At the end of the stretch so full of islands, clay banks first make their appearance on both sides, and continue all the way to the sea.

Brassy Hill, or The Hill, from which the river derives its name, and Brassy Hill. which is the only hill known to exist in the whole region, is a remarkable isolated mound of gravelly earth 392 feet in height. Its summit lies three-quarters of a mile east from the river, and four or five miles beyond the lower termination of the labyrinth of islands.

The clay banks are about thirty feet high where they begin, but in Clay banks. descending the stream they increase, by degrees, to 100 feet in the neighborhood of The Rock, and then gradually diminish to sixty feet at Fox's River. An average section of these banks in the interval consists of fifty feet of hard bluish or yellowish-grey drift clay, in which the pebbles are not conspicuous as components and boulders are rare, overlaid by twenty or thirty feet of stratified bluish clay with occasional boulders. In the last nine miles before reaching Fox's River, Hill River winds, with great regularity of distance from bend to bend, between banks about eighty feet high, and three-quarters of a mile apart. They consist of forty to fifty feet of drift at the base, and twenty to thirty feet of stratified bluish clay, or the same thickness of yellowish-brown gravelly earth at the top, with occasionally a bed of gravel between them.

From Brassy Hill to Fox River, few islands occur in the river, which Hill River has an average width of only about two chains. Several rapids and chutes over ledges of gneiss underlying the clay, occur in the first thirteen miles below Brassy Hill. The last one, at the end of the above distance, or 109 miles above York Factory, is called 'The Rock from a considerable exposure here of dark-grey, rather coarse gneiss. Gneiss was last seen in the bed of the river about six miles below The Rock, and it is supposed that the palæozoic basin of Hudson's Bay is entered upon in this neighborhood.

The character of the river changes at The Rock; and from that point Change in character of river. downward no more rapids occur all the way to the sea. The stream is shallow at low water and runs with a swift current to the head of tide-water, about nine miles above York Factory. The gravelly or sandy beach which is exposed during the summer nearly all along between the foot of the clay banks and the water, affords good walking for the men employed in tracking loaded boats up-stream.

Steel River, or the section of the route between Fox's River, from Steel River. the left at seventy-nine miles from York Factory, and the Shamattawa, from the right at fifty miles from the same point, has a width of about three chains. Clay banks, with an average height of seventy feet, are



continuous on both sides of Steel River throughout its whole course. Marine shells, chiefly *Saxicava rugosa*, derived from the upper beds were noticed all along this section of the river.

The Shamattawa appears to be a larger stream than the Steel River with which it unites and forms Haye's River. This last has an average width of about ten chains as far as the "Penneygutway," a small stream from the left, twenty-four miles above York Factory. Below this, the width is one quarter of a mile, but increases regularly to half-a-mile, and opposite York Factory it has become one mile. About a mile above "Penneygutway" the river gives off a channel on the right, which is of considerable size during floods, but is nearly dry at low water. It emerges again about three miles above York Factory, and is here called Ten-shilling Creek. In descending Haye's River, the clay banks diminish in height from an average of fifty feet at the termination of the Steel River to twenty-seven feet at York Factory.

Islands.

Along the stream above described, from the Rock downward, islands are almost entirely absent, until the head of tide-water is reached. Here three wooded islands occur in succession, and below them is a chain of low islands near the south-east side, covered with grass, and affording abundance of hay for the cattle kept at York Factory.

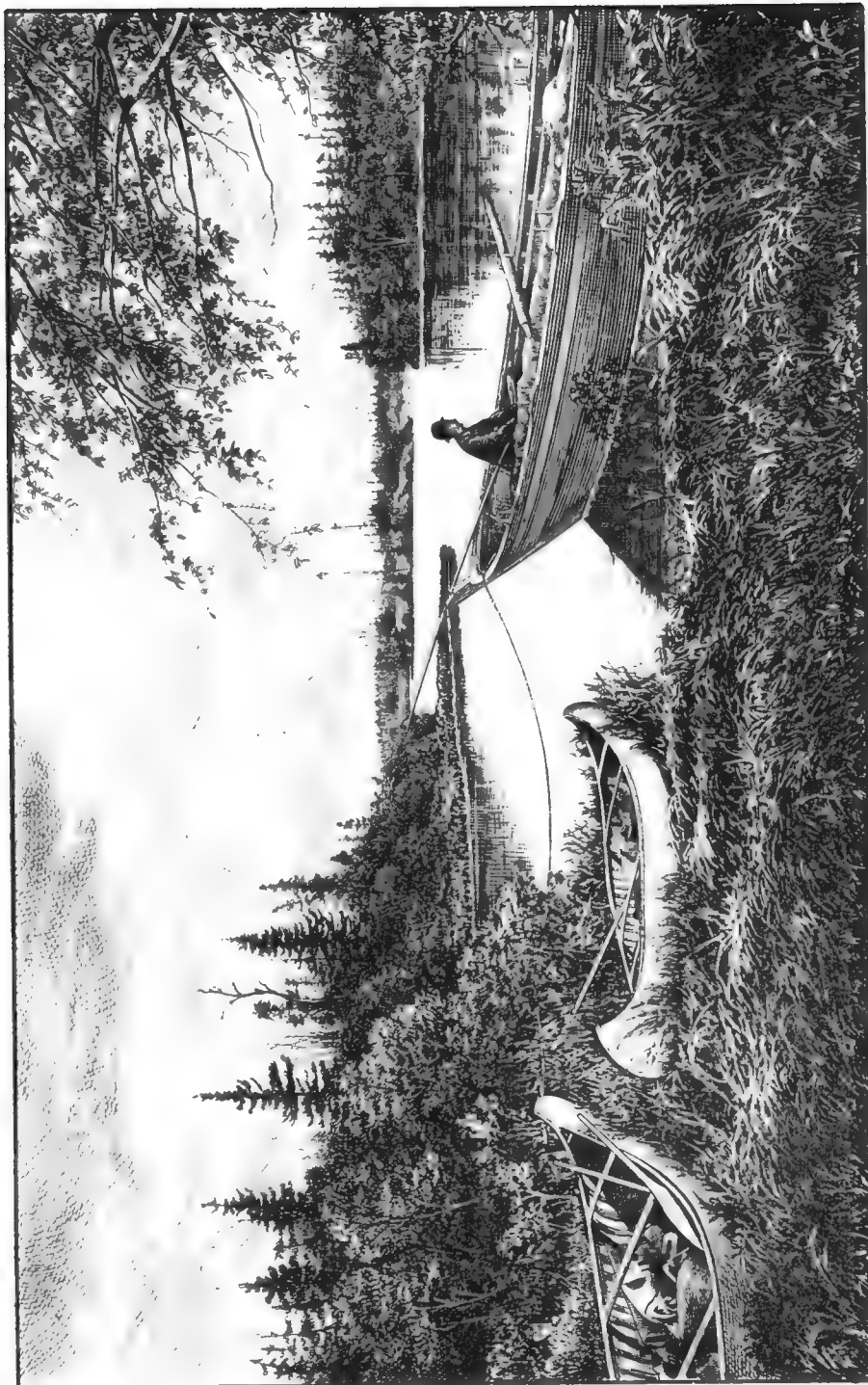
Palæozoic  
rocks.

The unaltered palæozoic rocks are not exposed on any part of the above route and their existence under the drift from near The Rock to York Factory is only inferred from the prevalence of limestone *débris* in the shingle, from the absence of the older metamorphic rocks, and from the general character of the country, which resembles that along the lower part of the Nelson River, where these rocks actually crop out.

Laurentian  
gneiss.

With the exception of the Huronian trough, already referred to, all the rocks seen *in situ* along the boat-route from Lake Winnipeg to Hudson's Bay, which has just been described, consist of varieties of Laurentian gneiss. These are not considered of sufficient interest or importance to merit a detailed description, and it is believed that the following summary of their dip, strike and general character, will be sufficient for present purposes. A knowledge of the direction of the strike in all these localities will be of service in the future working out of the geological structure of the surrounding country. It will be observed that its general run is about west-south-west, or in the same course which prevails over a vast area to the north and north-west of Lake Superior.





From Photo. by R. Bazell.

VIEW UP THE RIVER FROM WAPINAIPINIS PORTAGE.

*List shewing the Strike and Dip of the Gneiss along the Boat Route from Lake Winnipeg to Hudson's Bay, with Notes on the Local Character of the Rock.*

	Magnetic Bearing of the Strike	Strike of gneiss.
1. Along the channel between Great and Little Playgreen Lakes. Massive grey. Contorted. General run .....	S. 25° W.	
2. Two miles below Little Playgreen Lake. Reddish-grey with large patches of coarsely crystalline hornblende .....	S. 50° W.	
3. At three and four miles below Sea-river Falls. Dip south-eastward < 70°. Strike from N. 45° E. to .....	S. 45° W.	
4. The High Rock, between Sea-river Falls and Echimamish. Very micaceous; passing into schist. Dip southward < 70° ..	S. 70° W.	
5. Between the High Rock and Echimamish .....	S. 70° W.	
6. Echimamish, above Hairy Lake .....	S. 40° W.	
7. Echimamish, at the second dam .....	S. 75° W.	
8. Echimamish, two miles west of the height of land .....	S. 60° W.	
9. Echimamish, near the junction of White-water River .....	E. & W.	
10. Head of Robinson Portage. Dark-grey and reddish-grey ..	S. 80° W.	
11. Foot of Robinson Portage. Dark-grey, close-grained .....	S. 65° W.	
12. First rapid at about seven miles below Robinson Portage. Grey, massive, compact .....	S. 75° W.	
13. Outlet of Pine Lake. Micaceous. Dip southwestward < 80° ..	S. 35° W.	
14. Between Pine and Windy Lakes. Contorted. General strike about .....	N & S.	
15. Near Inlet of Windy Lake. Dip S.E. < 65° .....	S. 50° W.	
16. One mile above Wapinaipinis Rapid .....	S. 80° W.	
17. Wapinaipinis Rapid. Ordinary reddish-grey, with massive bands .....	S. 65° W.	
18. South-east shore of Oxford Lake, six miles north-east of inlet. Coarse grey, rough-surfaced, composed of quartz and mica. Strike from S. 55° W. to .....	S. 70° W.	
19. One mile below outlet of Pine Lake .....	S. 75° E.	
20. Between Pine and Swampy Lakes. Average strike .....	S. 70° W.	
21. Island near south-west extremity of Swampy Lake. Tender, grey, micaceous .....	S. 10° E.	
22. Camp Point, on north-west side of Swampy Lake .....	S. 85° W.	
23. Rapid at three miles below Swampy Lake .....	S. 80° W.	
24. Gun Rapid. Micaceous. Crosses the river at right angles. Dip N. < 70° .....	W	
25. Seesing Rapid. Ordinary grey. Dips northward < 65° .....	S. 80° W.	
26. Bocky Launcher Rapid .....	S. 65° W.	
27. Brassey Hill Rapid .....	S. 80° W.	
28. Island in the river six miles below Brassey Hill .....	S. 70° W.	
29. White-mud Fall. Grey, micaceous. Dip, southward < 75° ..	S. 80° E.	
30. Borwick's Fall. Grey micaceous .....	S. 80° E.	
31. The Rock. Dark, rather coarse grey .....	S. 60° E.	
32. Five miles below The Rock. Massive .....	S. 70° W.	

## LOWER PART OF NELSON RIVER.

**Map.** An exploration of the Nelson River was made for a distance of about ninety miles from the sea, following the stream. From the accompanying map it will be seen that the mouth of Haye's and Nelson Rivers are separated from each other by a low tongue of land, called Beacon Point. The shallowness of the water and the low monotonous character of the shores everywhere in this vicinity renders it difficult to draw a definite line between land and water. Extensive shoals stretch for miles out from the extremity of Beacon Point and from the shores to the north and south of the estuaries of the two rivers. Owing to these circumstances, the outline between the land and water is widely different at high and low tide. The difficulty of mapping the shore accurately is increased by the fact that the sea is receding at an appreciable rate, and also from the circumstance that the tides are of very irregular height, owing to the shallowness of the water for long distances in all directions and the great effect which the winds consequently have in increasing or diminishing the rise and fall.

**Mouth of Nelson River.** The mouth of the Nelson River at high tide has a breadth of six or seven miles opposite the extremity of Beacon Point, but it contracts rapidly, having a trumpet-like outline, and for the first ten miles up, the width is from three to four miles. It continues to narrow gradually to Seal Island at the head of tide-water, or twenty-four miles from the extremity of Beacon Point, (at high tide) where it is only one mile and a-half broad. Above this, it varies from half a mile to a mile and a-half as far as we went.

**Channel in estuary.** When the tide is out the greater part of the space between the banks in the estuary of the river is dry and consists of a dreary stretch of mud-flats dotted with boulders, constituting a continuation of the shoals further out. A narrow channel with a somewhat irregular depth of water winds down the centre of the estuary. From the soundings which I took it appears to have an average depth of from two to three fathoms at low tide from a point abreast of Beacon Point for about twenty miles up. At the mouth of the river the ordinary spring tides amount to about twelve feet and the neap tides to about six feet, so that at high tide, from three to five fathoms may be found throughout the above distance.

**Soundings.** The shallowest part of the river which we sounded was abreast of Gillam's and Seal Islands, or just where the tide ends and the proper channel of the river begins. Here the water was only about ten feet deep. But from this point upward, as far as we went, the average depth of the centre of the river was found to be twenty feet, and sometimes our soundings shewed over thirty feet of water. In this section

of the river, the velocity of the centre of the stream varied from about two to six miles an hour, according to the experiments which were made with the submerged tops of spruce trees, in order to ascertain the rate, at least approximately. The swift parts are short and the mean velocity may perhaps be taken at from two and a-half to three miles per hour and the average width at three-quarters of a mile between the water margins. Velocity of stream.

A short rapid occurs a few miles below the highest point to which we explored the river, but it does not appear too swift to be surmounted by steamers. Above it, the Indians report no obstructions for about fifteen miles, when a cascade, called Limestone Falls, is reached. The Nelson River may, therefore, be said to be navigable for river steamers to a distance of about one hundred miles from the sea. Navigation of the river.

The distance from York Factory to the extremity of Beacon Point is about five miles. In going towards the latter, the banks gradually diminish in elevation from twenty-seven feet at York Factory to the level of high tide at Beacon Point. They consist of stratified greyish clay combined with more or less fine sand. Below high tide the beach in the above interval consists of a muddy bluish clay with rounded pebbles and some boulders, and contains marine shells which are tolerably plentiful. Among those collected Mr. Whiteaves recognizes the following: *Leda pernula* (Moll), *Nucula tenuis* var. *inflata* (Hancock), *Mytilus edulis* (Linn), *Cardium Islandicum* (Linnaeus), *Macoma calcarea*, (Chemnitz), *Saxicava rugosa* (Lamarck), *Buccinum tenue* (Gray), *Natica affinis* (Gmelin). Clay banks.

As already stated, the shores about the mouth of Nelson River are very low and flat. Banks of clay, at first only a few feet high, begin to appear on both sides about ten miles above the extremity of Beacon Point, and in ascending the river, the banks of clay on either side gradually rise till a point is reached about fifty-four miles, in a straight line, from Beacon Point where they are nearly 200 feet in height, and above this, as far as observed, they maintain about the same elevation either immediately overlooking the river or at a short distance back from it. A layer of peat, averaging about four feet in thickness, was observed almost everywhere at the top of the bank on either side and extending inland. At Flamborough Head, a prominent point on the north-west side, nineteen miles from Beacon Point, the clay bank has attained a height of 126 feet. It consists of hard gravelly drift clay with some boulders at the bottom, and drab-colored stratified clay towards the top. At, and near the top, marine shells are abundant. Among the species observed were *Buccinum undatum*, *Tellina Grænlantica*, *T. proxima*, *Mya arenaria*, *Leda pernula*, *Saxicava rugosa*, and *Cardium Islandicum*. Flamborough Head.

About thirty-five miles further up, where the bank on the south east side has reached its maximum height of nearly 200 feet, it consists entirely of thinly-stratified yellowish-grey, fine clayey-sand or sandy clay, the thickest beds not exceeding seven inches, while others are only one inch thick. The thicker and thinner beds alternate with great regularity in some portions of the cliff. In one place in this vicinity, the whole depth of the deposit is seen in a perpendicular wall, which forms a favorite resort for great numbers of cliff swallows, their nests being built under the projecting edges of beds of the hard dry clay. Marine shells of most of the above named species are washed out of this bank, large valves of *Saxicava rugosa* being the most common.

Islands.

No islands occur in the estuary of the river, but from the head of tide, in the distance to which I descended, upwards of twenty, covered with timber, were passed, besides a number of others on which only grass was growing. The wooded islands are comparatively high, while the grassy ones are low and flat, and are evidently swept over by the river ice when it breaks up in spring. From the Puck-wa-ha-gun River (sixty miles from Beacon Point), upward, wide flats covered with good grass occur, here and there, on both sides of the river. The grassy islands and flats probably owe their preservation to the underlying horizontal beds of dolomite, which prevent them from being worn away by the force of the ice.

Silurian  
dolomite.

The dolomite, which is probably of Upper Silurian age, was first found *in situ*, in ascending the stream, about two miles above the Puck-wa-ha-gun River, or at sixty-two miles in a straight line from Beacon Point, where it is exposed at the edge of the water on both sides of the river. It was also met with on the south-east side at two and again at six miles further up. At the latter place, a cliff of thirty feet of it rises perpendicularly from the edge of deep water, beneath which the escarpment is continued downward.

At all the foregoing localities the rock has a yellowish grey color, is rather fine grained, soft and generally earthy, although some of the beds appear to constitute a tolerably pure dolomite. It is thinly bedded, with the exception of a few bands, for a foot or more in thickness at the last locality. The only fossil observed was an obscure *Pentamerus*, which was abundant in one of the beds, but none of the specimens were sufficiently well preserved to identify the species.

Effects of ice in  
the spring.

A slight rapid occurs near the highest point reached. Below it the river is narrower than it is above, and here there is evidence of great ice-packing in the spring. On the sloping bank on the north-west side, the timber is prevented from growing below forty-five feet above the river. The outermost trees standing on this level are barked by the ice and boulders, which have been pushed diagonally up the slope.



A great amphitheatre is excavated in the opposite bank, evidently by the water passing a temporary dam of ice, blocking up the river by piling at this point, after a spring shove. On the 18th of July last, some ice still remained, on the north-west bank, opposite to this amphitheatre-like excavation, but was melting rapidly under a hot sun.

The timber along the lower part of Nelson River consists principally of spruce, tamarack, aspen and balsam of Gilead. On the islands and lower levels, the spruce attains a good size and would be very suitable for building purposes, but on the level ground, stretching away from the tops of the banks, the timber is smaller, and the ground is covered with a thick growth of Sphagnum, under which a layer of peat, of variable thickness, is seen at the brink of each steep clay bank. Timber.

The detailed survey of a portion of Hayes' River, which was made in the vicinity of York Factory, extended from the mouth for a distance of about twelve miles up the river. The distances were ascertained by the Rochon micrometer-telescope, and the bearings were taken with a prismatic compass. The accompanying map, on a scale of one mile to the inch, shews the principal topographical features of this section of the river as determined by this survey. Survey of  
Hayes' River.

Immediately after my return to Norway House, I proceeded to make a track-survey of the Nelson River downward. This was accomplished to a distance of 180 miles from the commencement of the river at the outlet of Lake Winnipeg. Before returning, partial surveys were also made of Cross and Sipi-wesk lakes, which lie in the course of the river in this distance. Finally, a track-survey was completed of Great Playgreen Lake and the channel on the west side of Ross' Island and the Whiskey-jack Portage, which leads from it to Cross Lake. Survey of  
Nelson River.

The region through which the upper two-thirds of the Nelson River flows may be described as a tolerably even Laurentian plain, sloping towards the sea at the rate of about two feet in the mile. The river, for the first hundred miles from Great Playgreen Lake, does not flow in a valley, but spreads itself by many channels over a considerable breadth of country. This tendency to give off "stray" channels is characteristic of numerous rivers throughout the northern and comparatively level Laurentian regions, but it is perhaps more strongly marked in the Nelson than in any other. In the above section of this stream the straggling channels are of all sizes, from mere brooks up to large rivers. In their various courses towards the sea these channels, here and there, unite either wholly or partially, but often only to divide again, and thus they constitute a sort of network of rivers, the islands between them being of all sizes and shapes. The channels themselves consist of a series of dead-water stretches separated by chutes or rapids at longer or shorter intervals, which, however, vary Numerous  
channels.

much in the different channels. The greatest descent at any one of the chutes visited takes place at the White-mud Falls, and amounts to about twenty feet. These falls are divided by islands into three parts, and the "discharge" on which they occur is supposed to represent about half the volume of the Nelson River. The White-mud Falls were considered to represent more than twice the quantity of water which passes over the Chaudière Fall at Ottawa. Should this estimate be correct, the whole body of the Nelson River would be more than four times as great as the Ottawa at the above fall.

Volume of  
water.

The channels explored are shewn pretty correctly on the accompanying map, which serves to give a good idea of the general character of the river. Following the channel on the east side of Ross' Island, the first break in the smooth water extending down from Lake Winnipeg is the Sea-river Fall at thirty-seven miles from the outlet. At twenty-one miles further down we come to Pipestone Lake, which is on the same level as Cross Lake, and separated from it by an irregular strait five miles long. Between the level above Sea-river Fall and that of Pipestone Lake there are, in all, ten rapids with a total fall of about thirty feet. Making an allowance of ten feet more for the current in the smooth portions of the river, there would be a difference of about forty feet between the level of Lake Winnipeg and that of Pipestone and Cross Lakes. By the channel on the west side of Ross' Island the navigation is uninterrupted from Lake Winnipeg all the way to Big-reed Lake, one part of which comes within four miles of the southern extremity of Cross Lake. Between Cross and Sipi-wesk lakes ten more rapids occur, with a total fall of about eighty feet. This, with twenty feet for the current in the intervals between the rapids, would give a total descent of 100 feet from the one to the other. Below Sipi-wesk Lake no rapids, properly speaking, were met with as far as I went, but two others are reported to exist before Split Lake is reached. Above Sipi-wesk Lake the first rapid occurs at the Chain-of-Rocks, four miles up, and is very slight, having a fall of less than two feet. It could, no doubt, be easily passed by steamers. But the Red-rocks Rapids, at seven miles from the lake, are more serious, and would terminate the upward navigation of this section of the river. From these rapids, downward, including Sipi-wesk Lake, there appears to be no insurmountable obstruction to the navigation of the river by steamers till the higher of the two rapids above Split Lake is reached, a distance of upwards of 100 miles.

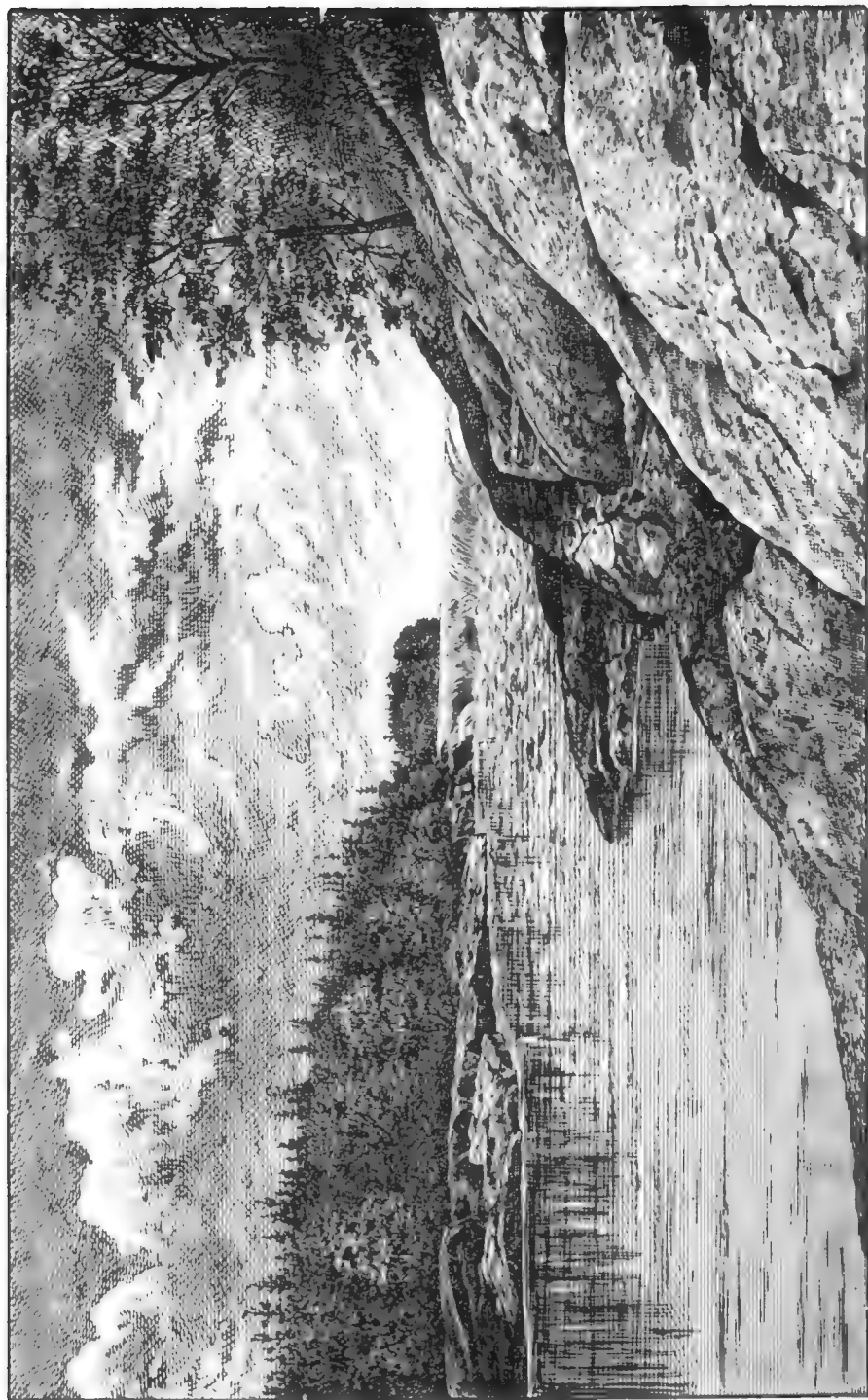
Pipestone and  
Cross Lakes.

Fall of the  
river.

Navigable  
stretch.

Course and  
character of  
the river.

Sipi-wesk Lake and the first twelve miles of the river below it run nearly north-east or with the general strike of the Laurentian gneiss and mica-schist on which they are situated, but at the above distance the river assumes a course bearing due north by compass, (nearly



From Photo. by R. Ball.

SOUTHERN CHANNEL OF WHITE-MUD FALLS, NELSON RIVER.

10/10/1910.



north-by-east astronomically) or diagonally across the strike of the gneiss and the course of the glacial striæ, both of which have a general N. E. and S. W. bearing. The branches from the right, in this interval, run south-west, while those from the left flow north-east. The whole of the waters of the Nelson River appear to have come together in this stretch for the first time since leaving Great Playgreen Lake. The width now averages about a quarter of a mile, or rather more, with a depth of from forty to fifty feet. The current runs at the rate of about three miles an hour in the middle, except at two very narrow parts where it is considerably greater. Owing apparently to the considerable depth of water across the greater part of the bed of the stream—strong eddies are found on both sides which greatly facilitate the up, ward navigation of this part of the river.

The remarkably straight north-and-south stretch of the river is reported to extend as far as Split Lake. Its eastern bank consists almost entirely of drift clay, while gneiss is exposed nearly all along the west side. This singular part of the river no doubt owes its location to the existence of a great dyke of dolerite, which appears to run along its whole course. Its width probably corresponds nearly with that of the bed of the stream, which has been excavated out of the trap, the latter appearing only on the extremities of points on either side and on the two or three small islands. The dolerite is divided by joints parallel to its course and is very friable. It is coarsely crystalline and has a dark brown color near the surface, owing to the presence of oxide of iron, but some fresh fractures shew a dark, somewhat greenish grey color. In some parts, white calcspar and compact olive-colored serpentine are developed in thin sheets in the numerous longitudinal joints and also in the horizontal and vertical tranverse partings, so that rectangular pieces of the dolerite, which crumble out, are completely encased in these minerals. Small streaks of magnetic iron, running parallel to the walls, were found in one part of the dyke.

The dyke itself may have a width of from 200 up to 1,000 feet or more, and owing to its friable nature and to its decomposing more rapidly than the gneiss of the surrounding country, it has been easily removed during the glacial period, and the present channel excavated. In some places the gneiss immediately adjoining the dyke on either side has been altered and jointed parallel to the walls, by the action of the trap. This would also aid in facilitating the scooping out of its channel. Both the gneiss and the harder points of the trap forming its walls are rounded and striated by glacial action.

The same dyke may be continued, with an altered course, up through Sipi-wesk Lake. At a point on the west side of the river, two miles above the inlet of this lake, a great dyke makes its appearance and is

Great trap  
dyke.

Serpentine.

Excavation of  
river channel.

Other trap  
dykes.

probably a part of the same one which crosses the stream two miles further up, forming the Chain-of-Rocks. The dolerite is here of the same character and contains the same peculiar serpentine as the dyke along the straight stretch of the river just described. Along the latter stretch, and also on the shores of Sipi-wesk Lake and the river above it, dark grey finely crystalline dolerite is frequently seen in the form of dykes of greater or less width, and also as patches filling angles in the walls of gneiss overlooking the water. On the sides of the straight stretch, these dykes generally run nearly parallel with the main one, but some of them follow the south-westward course of the stratification of the gneiss, and diminish in size in receding from the river, as if they were offshoots from the great dyke.

Great gneiss  
region.

Huronian rocks are developed in considerable force around Pipestone and Cross Lakes, apparently in continuation of the Oxford and Knee Lake troughs, but with this exception, the whole region explored along the upper part of Nelson River is occupied by Laurentian gneiss, diversified only by mica-schist and trap dykes. As these rocks appear to have little local interest from either a geological or an economical point of view, it is believed that the following list, shewing strike and other particulars in thirty-six localities in this region, will serve every purpose as well as a more detailed description.

Strike of  
gneiss.

*List shewing the Strike of the Gneiss at Various Locations along the Nelson River, arranged in their order from Lake Winnipeg downward. The Bearings refer to the Magnetic Meridian.*

1. Northwestern extremity or outlet of Great Playgreen Lake.  
Dip S.E.  $< 60^\circ$  ..... S.  $40^\circ$  W.
2. Southern arm of Cross Lake from Whiskey-jack Portage to Big-stone Point. Reddish-grey, mostly massive. Dip south-eastward about  $< 45^\circ$ . Average strike about. .... S.  $20^\circ$  W
3. Eastern channel, four miles above Pipestone Lake. Grey... S.  $30^\circ$  E.
4. Rapids at inlet of Pipestone Lake. Massive, fine-grained, red.  
General strike. .... S.  $45^\circ$  E.
5. From western outlet of Cross Lake to Pelican Falls Massive.  
Strike with river about ..... S
6. White-mud Falls. Strike straight and regular. Dip northward  $< 45^\circ$  ..... S.  $70^\circ$  E.
7. Bladder Portage. Grey..... S.  $60^\circ$  E
8. Two miles below Bladder Portage. Grey ..... S  $60^\circ$  E.
9. Rapid just above Red-rocks Portage. Nearly black, cut by granite veins. Very micaceous and full of large garnets.... S  $40^\circ$  W.
10. Two miles below Red-rocks Portage. Grey, micaceous, schistose. Dip westward  $< 45^\circ$ ..... S  $25^\circ$  W
11. South-west extremity of Sipi-wesk Lake. Dip eastward,  $<$  about  $75^\circ$  ..... S.  $30^\circ$  W.

12. Sipi-wesk Lake, north-west side, twelve miles below south-west extremity. Dark grey, hornblendic. .... S. 60° W.
13. Sipi-wesk Lake, south-east side, thirteen miles from south-west extremity. Grey, micaceous. Bedding vertical ..... S. 55° W.
14. Sipi-wesk Lake, fifteen miles from south-west extremity. Very micaceous, grey. Bedding runs in a straight course. . . S. 40° W.
15. Sipi-wesk Lake, twenty miles from south-west extremity. Coarse, grey, micaceous, tender. Dip S.E. < 60°. .... S. 45° W.
16. Sipi-wesk Lake, twenty-six miles from south-west extremity. Micaceous ..... S. 50° W.
17. Outlet of Sipi-wesk Lake. Ribboned, reddish color; contains nodules of iron pyrites, which decompose and form red particles in the surface gneiss. .... S. 65° W.
18. From outlet of Sipi-wesk Lake, for eight miles down Nelson River. Stratification vertical, or at high angles to north-westward; not contorted. General strike with course of river regular. . . . . S. 70° W.
19. Two miles above Devil's Brook. Epidotic, with compact felspar ..... S. 75° W.
20. Eighteen miles below Sipi-wesk Lake. Grey, quartzose, micaceous ..... S. 45° W.
21. One mile above Landing-lake River. Red and grey in alternate bands. Rather coarse. Dip N.W. < 70°. .... S. 40° W.
22. Two miles below Landing-lake River. Grey, micaceous ... S. 45° W.
23. "Sturgeon's Calling Place," three miles below Landing-lake River ..... S. 20° W.
24. Between Chain-of-Lakes and Broken-mouth Rivers from S. 35° W. to ..... S. 50° W.
25. Broken-mouth River. S. 75° W. to ..... S. 85° W.
26. Three miles above Island River. Dip southward < 70°. .... S. 80° W.
27. Just above upper mouth of Island River. Coarse, grey, Dip S E < 50°. .... S. 45° W.
28. Just below upper mouth of Island River. Dip eastward < 45° ..... S. 25° W.
30. From Spelling Brook to Stake-net River. Dip N.W. < 70° to 75° ..... S. 50° W.
31. One mile below Stake-net River. Massive, grey, micaceous. The gneiss in this neighborhood contains many isolated rounded masses of a different character from the matrix. and lying at various angles to the stratification. They are probably imbedded boulders ..... S. 70° W.
32. One mile above Devil's Rapid ..... S. 60° W.
33. Devil's Rapid. .... S. 7° W.
34. One mile below Devil's Rapid. .... W.
35. Three miles above Goose-hunting River. Massive, grey, quartzose ..... S. 45° W.
36. Mouth of Goose-hunting River. .... S. 75° W.

The general aspect of the country along the upper part of the Nelson River is even, or slightly undulating, the highest points seldom rising Aspect of the country.



more than thirty or forty feet above the general level. Whiskey-jack "Mountain," opposite the foot of Sea-river Falls, is only from thirty to sixty feet high. The "High Rock," four miles above the entrance to the Echimamish, has an elevation of only about fifty feet. Such terms, applied by the inhabitants to mere banks and hummocks, indicate the general level nature of the country. On the north-west side of the inlet of Sipi-wesk Lake the hills rise to a height of from 100 to 150 feet, and appear to be composed of clay or drift materials. Along the north-west side of the lower part of this lake, the ground has an elevation of about 100 feet. Partridge Hill, seven or eight miles eastward of the outlet of the same lake, is the highest point observed in the district, and has an elevation of about 200 feet over the water.

Nature of the surface.

The solid rocks of the region are generally overspread with the prevailing grey clay, which, in some cases, is liable to bake and crack in the sun, but in others it forms a soft, mellow soil of excellent quality. Of course a good deal of fixed rock is exposed at the water's edge along the principal water-courses, but even in these situations the upper parts of the banks, including those of the smaller islands, are generally composed of clay.

On either side of the channel west of Ross' Island, the country is rather barren. The shores are low, and consist mostly of points and knobs of gneiss with sandy bays, and bogs and marshes between them. Whiskey-jack Portage, which connects the heads of two bays from opposite directions, passes along a strip of dry, coarse sand, which looks as if it might have formed the north-western side of an ancient water-course.

#### HURONIAN TROUGH.

The Huronian rocks of Pipestone and Cross Lakes, the Echimamish, Oxford Lake, Trout River and Knee Lake all probably belong to one basin or trough running in a south-westward course, conforming with the general trend of the Laurentian gneiss and mica-schists. Its extremities probably lie near the west side of Cross Lake to the south-west and the outlet of Knee Lake. Its total length would, therefore, appear to be about 143 miles, and it has probably an average breadth of about fourteen miles, and an area of about 2,000 square miles. It presents a considerable variety of crystalline schists, coarse diorites, &c. These, like the Huronian rocks in other parts of the Dominion, may prove to be the repositories of valuable minerals, and, therefore, the area indicated is of more interest than the great gneissic region around it. The principal varieties of rocks examined within this trough, will be described in the order of their occurrence from south-west to north-

Position and extent of Huronian trough.

east. The directions of the strike, &c., are referred to the magnetic meridian.

On the southern shore of the main body of Pipestone Lake the prevailing rock is a dark green laminated calcareous hornblende schist, with vein-like streaks and lenticular patches of white quartz. It runs N. 70° W., and dips southward at an angle of about 75°. On an islet about one mile off the central part of this shore there is a softer hornblende schist with laminae of white calcspar and bunches of quartz with chlorite, associated with a glossy-surfaced chloritoid schist. An island about a mile to the north-west of the last is composed of massive grey, rather coarsely crystalline, diorite. The islands in the outlet of the lake consist of green hornblende and mica-schists, with irregular veins of bluish-grey quartz conforming with the stratification, which here runs N. 70° W. and dips northward at an angle of 80°. Along the strait five miles in length, which connects Pipestone Lake, with Cross Lake the rocks on both sides consist of grey mica-schists, with pebbles of different kinds and rounded grains of quartz, either closely crowded together or scattered sparingly through the mass. At a point on the south side of the strait, and two miles from Pipestone Lake, a conglomerate band occurs in the midst of a grey, rather soft, and somewhat fine-grained mica-schist running N. 55° W., dip N.E. < 80°. The pebbles in the conglomerate range from coarse sand up to the size of a child's head. Most of them approach a spherical form, and consist of fine-grained, hard grey syenite. Others are of white quartz, and are also well rounded. At a point on the north side of this strait, just before entering Cross Lake, a few large and somewhat angular boulders of a light grey steatitic schist rest on the pitted surface of a massive grey silicious mica-schist holding an abundance of small pebbles, which have a tendency to occur in bunches. The steatitic schist, which an Indian afterwards informed me is to be found *in situ* somewhere in the vicinity, breaks into ligniform splinters, and is used by the natives for making tobacco pipes, from which circumstance the adjoining lake derives its name.

Along the eastern side of the (Indian) Reserve Island and adjacent smaller islands, from Otter Island to Big-stone Point, the rock is a dark green calcareous hornblende-schist with some fine grained mica-schist of the same color. The strike is S. 60° W., dip south-eastward < 85°. At Big-stone Point, the Laurentian gneiss begins. A dark grey, coarsely crystalline massive diorite occurs along the narrows on the east side of the Reserve Island, and the opposite point on which Chief Taipistainum resides. Two miles further north, a light-grey massive quartzite was found on both sides of the same channel. The extreme north point of the Reserve Island is formed of a dark grey

Rocks of  
Pipestone  
Lake.

Indian Reserve  
and other  
islands.

**Dyke of  
dolerite.**

granite or granitoid gneiss, in which the lamination is very obscure. A small dyke of fine grained dark-grey dolerite running N. 5° W. here cuts this rock. Grey mica-schist was found on all the islands visited in the western part of Cross Lake, between the Reserve Island and the outlets. On an island, a mile south of the central outlet, (one of a chain running with the strike) the mica-schist is of a conglomerate character, being full of pebbles and small lenticular masses of grey syenite and quartzite. The matrix is rather coarse, dark-grey, with rusty surfaces in some parts and holds a few garnets. The bedding is vertical and runs S. 55° W. On several other islands which were visited around the western extremity of the lake, the strike of the grey mica-schist was S. 25° to 30° W., dip north-westward, < 80°. The north-west shore of Cross Lake is formed of Laurentian gneiss, and the channels of the river, soon after leaving the lake, have a rapid descent. Both the geological and the geographical features of this locality therefore bear a strong resemblance to those of the outlets of the Lake of the Woods.

**Echimamish.**

On the Echimamish, the Huronian rocks were first seen about twelve miles east of the Nelson River, from which point they are continuous to the junction of the White-water, excepting for a short interval, occupied by gneiss between the second dam and the watershed, in which the stream makes a detour to the south and passes beyond the boundary of the Huronian basin. Up to the first dam the Huronian rocks consist of glossy grey and greenish grey fine-grained mica schist, in a vertical attitude, the strike varying from W. to S. 60° W.

At the first dam a very dark grey quartzite, composed of grains of vitreous quartz mixed with finer silicious particles, is interstratified with thin layers and groups of layers of nearly black clay-slate, and holds bunches of smoky vitreous quartz. It is associated with grey felsite slate. The strike is S. 80° W. and the bedding vertical. Immediately to the south of the dam mica-schists again make their appearance. Close to the Laurentian gneiss, six miles further up the stream, dark-grey slaty quartzite occurs with the same strike as the gneiss, namely S. 75° W. About a mile west of the watershed, at Painted Stone, the gneiss gives place to greyish mica-schist, having a strike varying from S 60° W. to S. 70° W. At the water-shed and for a mile down the south side of the eastern section of the Echimamish, the rock is a grey quartzite, strongly ribboned with reddish and lighter grey streaks. The strike is S. 70° W., vertical. Fine-grained greenish-grey mica-schist having the same strike occurs on the opposite side of the channel. Beginning about two miles east of the water-shed, coarse reddish granite and a gneissoid rock become associated with the mica-schist as far as the junction of the White-water, five miles further.

As stated in a previous part of this report, Laurentian gneiss was found along the whole course of Franklin's River, the Huronian rocks appearing again on the south shore of Oxford Lake five miles east of the opening from the Wapinaipinis marsh, which may be considered as the mouth of Franklin's River.

Franklin's  
River and  
Oxford Lake.

The junction of the two formations, which appear as usual to be conformable with each other, occurs just where the south-west area opens into the main body of the lake. Here the last of the Laurentian series consists of gray coarse rough-surfaced quartz and mica-rock. The first rock on what is considered to be the Huronian side of the boundary between the two series, consists of highly crystalline dark green hornblende-schist, ribboned with fine lines of white quartz grains. It is identical in character with the hornblende schist which is usually found at the base of the Huronian bands in the region to the north-westward of Lake Superior. This schist is interstratified with bands of finely ribboned grey gneiss, which like all the Huronian gneisses I have ever met with, is slightly calcareous. The strike at this locality is S. 70° W., but on an island about a mile further on our course to Oxford House a fine grained hornblende runs S. 50° W. At the distance of another mile, a rather massive crystalline diorite was found on one of the larger islands. Three miles further we passed through a gap, called The Doorway, in a chain of islands. Here the rock is a grey micaceous slate conglomerate. The rock of the islands about three miles south-west of the Seven-mile Point, or ten miles from Oxford House, consists of a soft, greenish, calcareous mica-schist with rounded pebbles and grains, mostly of white quartz. Seven-mile Point is formed of a grey finely micaceous slate conglomerate in which the pebbles are abundant, well rounded and composed principally of grey-syenite and light-grey quartzite.

Junction of  
Laurentian  
and Huronian  
rocks.

Calcareous  
gneisses.

Slate  
conglomerates.

Chloritic schist with pebbles of syenite and pebbles or patches of compact white and grey quartzite is exposed along the upper part of Trout River about one mile and a-half south-east of Oxford House. The strike varies from N. 55° to 65° W. Midway between Oxford and Knee Lakes, soft fine-grained ash-grey and dark iron-grey mica-schist occurs in the bed of the river for a distance of two miles. The stratification is contorted. At Trout Fall, one mile above Knee Lake, the water pours nearly perpendicularly about ten feet over a rather massive grey argillaceous and finely micaceous quartzite running N. 30° W., and shewing rather indistinct diagonal stratification. On the south side of the inlet of Knee Lake, layers of fine-grained magnetic iron are interstratified with grey siliceous and micaceous schists, running about east and west. This ore has a great effect on the compass, even at some distance off. A strong magnetic disturbance was also

Trout Fall and  
Knee Lake.

noticed at about two-thirds of the distance from Oxford Lake, probably due to the same cause.

Grey and coarse greenish-grey mica-schists, running S. 65° W., were met with around the south-western extremity, or head of Knee Lake. Grey quartzite was found about six miles down the lake, and again at about twelve miles. In a narrow part of the lake, full of islands, between the last distance and "McKay's Rocks," grey mica-schists, generally of a soft nature, are largely developed, and strike from S. 45° to 55° W.

Magnetic iron.

One part of the narrows in the middle of the lake contracts to a few chains, and has a perceptible current passing through it. A small islet in this current and the western shore abreast of it consist of fine-grained magnetic iron in thin layers, interlaminated with others of quartzite and mica-schist. The rock is twisted and corrugated, and breaks with a splintery fracture. The local magnetic attraction is so great in this neighborhood as to render the compass quite useless. A short distance to the southward a coarse crystalline diorite having a north-and-south strike is exposed. The numerous islands in the narrow central part of the lake consist of greenish-grey schists, amongst which hornblendic, argillaceous and micaceous varieties prevail. The strike in the centre of the archipelago is N. 75° to 80° W. The point on the south-east side, fifteen miles from the outlet, consists of hard, finely crystalline slaty, green diorite with calcareous surfaces and joints. At a point on the north-west side, six miles from the outlet, the rock is a mica-schist conglomerate. The matrix is fine-grained, dark-grey and hard, while the pebbles and boulders, which are well rounded, consist of grey syenites, the largest of them measuring two feet in diameter. The strike is here S. 80° W. Laurentian gneiss, running N. 75° W., makes its appearance on the Jack River about three miles below the outlet of Knee Lake, and continues thence all along the route to a point six miles below The Rock. Between Knee and Swampy Lakes it is very micaceous, and is cut by many veins of coarse light-colored granite.

#### TRACK-SURVEY OF A PORTION OF LAKE WINNIPEG.

Survey of Lake  
Winnipeg.

As stated in a previous part of this report, a track-survey was made of the east coast of Lake Winnipeg from the outlet to the Dog's Head, and from thence, of the west shore and the islands as far as Drunken River, which lies within the actual surveys which had been made by the Dominion Lands Department. The total distance between these localities is 206 miles. The error in these surveys, which did not prove to be great, was well checked from point to point by a number

of latitudes. By means of this work and the track-surveys of other portions of the coast line which had been made by previous explorers, together with the Dominion Lands surveys around the southern extremity, I have been enabled to complete the map of the whole lake, which accompanies this report. The coast between Lorn's Strait and Fort Alexander, for which no definite authority could be found, is less accurately represented than the other portions. Map.

From a geological point of view, the east coast of Lake Winnipeg between the outlet and the Dog's Head does not appear to present much of interest or importance. The whole shore is low and sandy, with points and numerous small islands and reefs of Laurentian gneiss. These and the shallowness of the water render navigation rather difficult in approaching the land in large vessels. A light grey clay like that of the Nelson River region was frequently noticed, and was said to occupy a good deal of the surface from the lake shore inland. I was informed by a person who said that he had traversed the country, that towards the height of land a good deal of clayey land of fair quality extends southward almost to Beren's River. But for some miles inland the country east of Lake Winnipeg, from one extremity to the other, as far as it has been explored, is reported to consist mainly of rock and swamps. It is, however, very imperfectly known, the explorations hitherto made being of very limited extent compared with the whole area. It affords but little promise of valuable timber or minerals. The north-western limit of the white and red pine is about the Winnipeg River and the eastern border of the prairies. Geological features of the east shore.  
Minerals and timber.

On the east coast of Lake Winnipeg, besides the Laurentian gneiss, a belt of Huronian schists, chiefly micaceous, occupies a long stretch of the shore between Big Island and Point Metusse. A *reconnaissance* of this part of the coast was made in 1874, and these rocks are referred to in my report for that year, page 39. The gneiss of the portion of the east coast explored the present season does not require a more extended description than is contained in the following list, showing the strike at intervals throughout this section:—

*List shewing the Strike of the Gneiss at Locations along the East Side of Lake Winnipeg.* Strike of gneiss.

1. Twenty-five miles northward from Poplar Point..... S. 25° E.
2. Point opposite Spider Islands, mostly very massive coarse grey S. 25° E.
3. Spider Islands. Grey. Dip eastward < 80°..... S 28° W.
4. Coast near the Shoal Islands. Coarse, dark grey, massive... S. 25° E.
5. Poplar Point. Massive grey with black patches. Contorted.  
General strike..... S. 45° E.
6. Four miles south-east of Poplar Point. Grey. Dip westward  
< 45°..... S. 12° W.

7. Point opposite George's Island. Contorted. General strike.. E. & W.
8. Lob-stick Island, near Beren's River. Massive, dark grey... S. 60° E.
9. Point three miles south of Beren's River..... S. 55° E.
10. Pigeon Point. Massive-grey. General strike about..... S. 45° W.
11. Main east shore opposite Dog's Head. Grey and red in  
alternating layers running in straight lines..... W. 70° W.

#### SURFACE GEOLOGY.

##### Clay soil.

The nature of the superficial deposits and the character of the soil have been referred to in describing the regions explored during the season. The prevalence of a light-colored clay, often constituting a good soil, free from boulders, over such a large region, is a fact of much importance in regard to the future value of this part of the country. This deposit is said to extend over the greater part of the region between the Nelson and the Churchill Rivers, and even beyond the latter. As we have seen, however, sandy and barren tracts are not wanting.

##### View from Brassey Hill.

The lower portions of the clay banks along the Hill, Steel and Haye's Rivers, and also along the lower level of the Nelson River, are composed of a fine kind of drift, in which the clay itself forms the bulk of the mass, boulders being generally absent and pebbles scarce. The stratified clay, which usually forms the upper parts of the banks has a rather lighter color than the drift clay below. In the region lying towards the sea, in which the clay banks occur along the rivers, the country appears to be everywhere nearly level and covered with a monotonous growth of rather small timber, consisting chiefly of spruce and tamarack. The accompanying view from the top of Brassey Hill, which extends over a distance of thirty miles, will serve to give an idea of the appearance of the surface of the country throughout this great region, which extends to the east and north far beyond the limits of last season's explorations.

##### Composition of the drift.

In regard to the source of the materials composing the drift along the above rivers, I found, among the pebbles, besides gneiss, green schists and the unaltered yellowish-grey earthy dolomite, supposed to underlie the country for a hundred miles from York Factory, a large proportion of various rocks of the Manitounuck and Nastapoka groups, with which I was familiar, on the east coast of Hudson's Bay, and which resemble those of the Nipigon series. Among the latter occurring in the drift, may be mentioned the very dark grey quartzite with occasional light spots, which, on weathering out, form rounded pits on the surface, the bluish-grey dolomite with concentric, cherty, concretions, similar dolomites having reddish layers, the blackish slates





From Photo. by R. B. Bell.

VIEW FROM BRASSY HILL.



accompanying the dolomites and quartzites and a peculiar variety of red jasper such as that of Long Island.

In my report for 1877,\* I have shewn that on the Eastmain coast there is evidence proving that the waters of Hudson's Bay are receding. The same phenomenon is manifest in the neighborhood of the mouths of the Nelson and Haye's River. It is said that within the recollection of the generation preceding the present one, the island called Mile Lands, just above the present site of York Factory was submerged at high tide. Now it is a dry island, several feet above high tide-mark. Hay Island, in the middle of the river, opposite to York Factory, has not yet become overgrown with trees or bushes, although it is now never swept by the ice breaking up when in the spring, and the Hudson's Bay Company stack their hay upon it with perfect safety. Four-mile Island has become overgrown with small poplars, while it is evident that at no very distant period Six-mile Island formed two islands, which are now covered with full-sized trees, while the old channel between them now supports a growth of tall bushes. Further up the river, similar dry channels, more or less ancient, separate former islands from the main shores, and the appearances indicate that the conditions which once existed here, have been removed further down the river. It is said that about the beginning of the present century some vessels wintered in Ten-shilling Creek, which could not now approach its mouth, and an old sketch-map shews a channel connecting Haye's and Nelson Rivers which does not now exist. There is no evidence of the sea anywhere encroaching upon the land. On the contrary, the wide open border between the woods and the water indicates that the latter is retiring. On Beacon Point and the opposite side of Haye's River, in traversing this border from the sea inland, one meets first with sedges and grasses; next come bushes, then small trees, and finally, the full-sized timber of the country. There is much old drift-wood near the tree-line, which is now apparently never touched by the water. The Indians say that their old goose-hunting grounds along the coast to the northward of the mouth of the Nelson River are now deserted by the geese, the water having "dried up."

Subsidence of  
Hudson's Bay.

The country to the northward of Lake Winnipeg is emphatically a region of lakes. The general character of the district renders it possible for the rock-basins to occupy a large proportion of the whole area. The solidity of the fundamental rocks and the impervious nature of the clay combine to render permanent all the lakes which may have been

Region of lakes.

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\* The phenomenon described would perhaps be more correctly stated as an elevation of the land.  
A. R. C. S.

Origin of small  
lakes.

formed during the later geological history of the region. Besides the larger lakes the mixture of land and water in some of the intervening tracts appears to be interminable. The origin of this condition is evidently owing to the glacial force having crossed at greater or less angles, the strike, cleavage or jointing of the rocks. The fact of the deep channel of the long straight stretch of the Nelson River between Sipi-wesk and Split Lakes having been scooped out along the course of a large dyke of decomposing dolerite, has already been noticed. The smaller lakes are generally not deep, and considerable areas of their shallower portions are covered with tall reeds growing from the bottom.

Intersecting  
striae.

The glacial striae are usually well-marked on the rock-surfaces in all parts of the region examined. The section of Hill River between Swampy Lake and Brassey Hill, in which small islands are so very numerous, appears to be an exception in this respect. In this part of the river the descent is unusually rapid, and the gneiss is much broken up into angular masses of all sizes in a manner not observed in any other locality. The general course of the striae is southwestward, but it is often locally modified by the contour of the rocky surfaces in the neighborhood. The walls of the narrow ravine in the gneiss in which Franklin's River flows for seven miles before entering Pine Lake, are both horizontally striated. Gaps in the continuity of the walls are filled with drift, containing rounded boulders, numbers of which are also perched on the rocks on either side of the ravine. In some localities the glacial scratches cross each other at considerable angles. This is the case especially at The Rock in Hill River and on Sipi-wesk Lake. Wherever the rivers flow in rocky channels, these have apparently been excavated during the glacial period before the deposition of the softer deposits. The streams have sometimes cut down through a considerable depth of drift in order to follow a rocky channel lying beneath. A singular case of this kind occurs on the Nelson River above the Puck-wa-hagan, where both sides at the edge of the water consist of flat-bedded dolomite with banks of clay above it, and a comparatively deep river channel below the level of the dolomite of either side.

List of glacial  
striae.

The following list shews the directions of the glacial striae in sixty-six localities scattered over the region explored. The bearings refer to the magnetic meridian. The variation around Lake Winnipeg averages about  $15^{\circ}$  E.; at Norway House it is  $13^{\circ}$  or  $14^{\circ}$  E., and at York Factory  $5\frac{1}{2}^{\circ}$  E., diminishing between the last two places proportionately to the distance :

## LIST OF GLACIAL STRIÆ.

*East Shore of Lake Winnipeg.*

1. Rabbit Point..... S. 33° W.
2. Pigeon Point..... S. 40° W.
3. Point three miles south of Beren's River..... S. 42° W.
4. Hudson's Bay Company's post at Beren's River..... S. 45° W.
5. Lob-stick Island, near Beren's River..... S. 42° W.
6. Point opposite George's Island..... S. 15° W.
7. Four miles south-east of Poplar Point..... S. 15° W.
8. Poplar Point..... S. 20° W.
9. Shoal Island Point..... S. 15° W.
10. Point opposite Spider Islands..... S. 20° W.
11. Spider Islands..... S. 25° W.

*Along the Boat Route from Lake Winnipeg to Hudson's Bay.*

12. Montreal Point, near outlet of Lake Winnipeg..... S. 30° W.
13. Kettle Island, in outlet of Lake Winnipeg..... S. 25° W.
14. Playgreen Point, Great Playgreen Lake..... S. 40° W.
15. Channel between Great and Little Playgreen Lakes..... S. 45° W.
16. One mile below outlet of Little Playgreen Lake..... S. 30° W.
17. East Channel, Nelson River, between Pine River and Sea-river Falls..... S. 40° W.
18. East Channel, Nelson River, three miles below Sea-river Falls..... S. 45° W.
19. East Channel, Nelson River, below The High Rock..... S. 45° W.
20. East Channel, Nelson River, two miles above Echimamish .. S. 35° W.
21. Hairy Lake and for seven miles above it, S. 30° W to..... S. 45° W.
22. Echimamish, at the first dam..... S. 30° W.
23. Echimamish, at the second dam..... S. 20° W.
24. Echimamish, two miles west of junction of White-water River..... S. 30° W.
25. Robinson Portage..... S. 20° W.
26. Seven miles below Robinson Portage..... S. 30° W.
27. Portage two miles above Pine Lake, runs with course of rocky defile, about..... S. 20° W.
28. Outlet of Pine Lake..... S. 45° W.
29. Outlet of Windy Lake..... S. 35° W.
30. One mile above Wapinaipinis Rapids..... S. 45° W.
31. Wapinaipinis Rapids, two miles above Oxford Lake..... S. 35° W.
32. Island five miles south-west of The Doorway, Oxford Lake.. S. 40° W.
33. One mile south-east of Oxford House..... S. 35° W.
34. Little White-mud Rapid, between Oxford and Knee Lakes... S. 50° W.
35. South-west extremity of Knee Lake..... S. 45° W.
36. Three miles north-east of south-west extremity of Knee Lake S. 25° W.
37. Ten " " " " " " " " S. 30° W.
38. Fourteen miles " " " " " " " " S. 35° W.
39. Archipelago in north-and-south narrows about mid-way down Knee Lake..... S. 40° W.

40. North-west shore of Knee Lake, six miles from the outlet... S. 50° W.
41. Outlet of Knee Lake..... S. 50° W.
42. One mile above White-mud Fall, Hill River..... S. 20° W.
43. Borwick's Fall, Hill River..... S. 10° W.
44. The Rock, Hill River. Older set run N. 87° W. Newer set. S. 18° E
45. Six miles below The Rock..... S. 20° E.

*Along the Nelson River, from Great Playgreen Lake downwards.*

46. In different places around the north-eastern extremity of Big-reed Lake..... S. 30° W
47. Six miles south-east of Pipestone Lake..... S. 40° W.
48. Four miles south-west of Pipestone Lake..... S. 30° W.
49. South shore of main body of Pipestone Lake..... S. 25° W.
50. Outlet of Pipestone Lake..... S. 40° W.
51. North-east point of (Indian) Reserve Island and smaller islands in Cross Lake..... S. 40° W
52. From western outlet of Cross Lake to Pelican Falls..... S. 50° W.
53. Bladder Portage..... S. 50° W.
54. Two miles below Bladder Portage..... S. 50° W.
55. Two miles below Red-Rocks Portage..... S. 45° W.
56. South-west extremity of Sipi-wesk Lake..... S. 50° W
57. Islands four miles down Sipi-wesk Lake..... S. 40° W.
58. Sipi-wesk Lake, twelve miles from south-west extremity, S. 45° W., and..... S. 80° W
59. Average course throughout south-western half of Sipi-wesk Lake, S. 40° W. to..... S. 45° W
60. Current Narrows, five miles above outlet of Sipi-wesk Lake.. S. 60° W.
61. From outlet of Sipi-wesk Lake for seven miles down river, S. 55° W to..... S. 60° W.
62. Mouth of Landing-lake River..... S. 50° W
63. Two miles above Stake-net River..... S. 40° W.
64. Head of Devil's Rapid..... S. 75° W
65. One mile below Devil's Rapid..... S. 40° W
66. Mouth of Goose-hunting River..... S. 75° W.

TIMBER, CLIMATE, &C.

Northern limit  
of twenty-two  
varieties of  
timber.

In going northward from the United States boundary at the Lake of the Woods by way of Winnipeg River and lake, the Nelson River, and the sea-coast northward of its mouth, the different species of trees which are found growing at the boundary line disappear in the following order:—Basswood, sugar maple, yellow birch, white ash, soft maple, grey elm, white and red pine, red oak, black ash, white cedar, serrated-leafed poplar, mountain ash, balsam fir, white birch, Banksian pine, balm of Gilead, aspen, tamarack, white and black spruce, willows. For information as to the region beyond the Nelson River, I am indebted to officers of the Hudson's Bay Company. The ash-leafed maple is only

met with after reaching the prairie region, and disappears to the north-eastward between Lower Fort Garry and Lake Winnipeg. The dwarf variety of the red cedar extends widely over the prairie country, and is found on the shores of Lake Winnipeg. Outside of the general northern limit of any of these species of timber, straggling trees or small groves of a stunted variety are sometimes met with. The proper north-western limit of the white cedar is about the Winnipeg River, but small trees occur south side of Long Point, on the west shore of Lake Winnipeg, and the last of it is seen in the form of bushes around Cedar Lake, on the lower part of the Saskatchewan River. Small trees of red oak are found as far north as the English River for some distance above its junction with the Winnipeg, but stunted bushes belonging to this species extend to Beren's River. The red and white pine maintain a good size to the Winnipeg River, where they both cease rather abruptly in their northward range, and are not found to the westward. The general northward limit of the balsam fir is about the latitude of the Echimamish, but isolated bushes of it were found as far as Knee Lake. The white birch terminates about the junction of the Shamattawa and Steel Rivers, and the Banksian pine in nearly the same latitude. The poplar and the tamarack are said to disappear between the Nelson River and the lower part of the Churchill, while the black spruce is found for some distance beyond Seal River. White spruce of fair size for building purposes is found on the islands and flats along the lower part of the Nelson River. In going northward, there is of course a gradual diminution in the size of the trees and the height of the forest, as well as in the number of the species. Owing, however, to the fires which sweep over large tracts at different periods, it is seldom that one sees the full size to which the trees are capable of growing. A small area of the timber has been preserved on the west side of Ross' Island, where the West River enters Big-reed Lake, and here many of the white spruces measure three feet in diameter. Even the most rocky tracts support a growth of trees large enough to be of value for many purposes, should this great territory ever become inhabited by civilized men. The accompanying view of the Manasitchewan Fall (where the water is precipitated directly into the Nelson River in about latitude  $55^{\circ} 30'$ ), also shews the usual character of the forest in the more rocky parts of the region.

Forest fires.

View showing character of forest.

The forests and the flora generally of the Nelson River region indicate a milder climate than that of the corresponding tract on the opposite side of Hudson's Bay. This appears to be at least partly due to the southerly winds which prevail in summer, bringing the warm air, probably from the valley of the Mississippi down that of the Red River and over the whole length of Lake Winnipeg, which has a high

Warm winds.

Crops at  
Norway House. and even temperature during the summer months. This condition of things also prevents the occurrence of summer frosts in the Norway House region, which appears to enjoy a climate fully as good as that of the Province of Manitoba. Small fruits, cucumbers, musk-melons and vegetables of all kinds come to maturity at Norway House. Barley is a sure crop. Hitherto, as there has been no object to be gained in attempting the cultivation of wheat, the experiment does not appear to have been tried in this region; but there is every probability that it would succeed, as this cereal is known to come to great perfection in the Athabaska and Peace River region, in localities more than a thousand miles to the north-north-westward.

Warm water  
and climate Nelson River carries with it towards the sea the high temperature of Lake Winnipeg, derived partly from the rivers of the south and west. The effect of this is to induce a rank growth of reeds, rushes, and a variety of water plants in the clayey mud along its banks. The climate of this region is pleasant in summer, without an excess of rain, and in winter the weather, although cold, is said to be bright and uniform, with only a moderate amount of snow. The land would be easy to clear of timber; and, considering the unlimited supply of wood for building purposes, fuel, &c., the prevalence of good water, in which a variety of excellent food-fishes abound, as well as the greater proximity of this region to Europe, it offers some inducements to immigrants which are not to be met with in the greater part of the prairie country to the westward.

Abundance of  
food-fishes. At Oxford House, barley, peas, beans, root-crops, vegetables and hay thrive well, and the surrounding district might make a good dairy and stock-farming country. Even as far as York Factory, potatoes and some kinds of vegetables may be successfully cultivated. It is said that at a certain depth, the ground remains permanently frozen along Steel and Haye's Rivers and the lower part of the Nelson. There is certainly evidence of the existence of frost in the banks of these rivers and under the peaty layer above them in the month of July, but it is known that in southern parts of the Dominion the frost penetrates to a greater depth into the face of exposed banks than into the level ground, and is frequently found in such situations in the middle of summer. Ice or frozen ground may also be found in some swamps or under peaty ground throughout the summer in any of the provinces. Should it be found that the subsoil towards York Factory is permanently frozen (which is not improbable, although not proved) this circumstance would not render it entirely unfit for cultivation, since when cleared, it is known to be thawed during the summer to, at least, a sufficient depth for all practical purposes. In this region about twenty feet below the top of the bank there is a step a few feet

Crops at  
Oxford House.

Frozen ground.



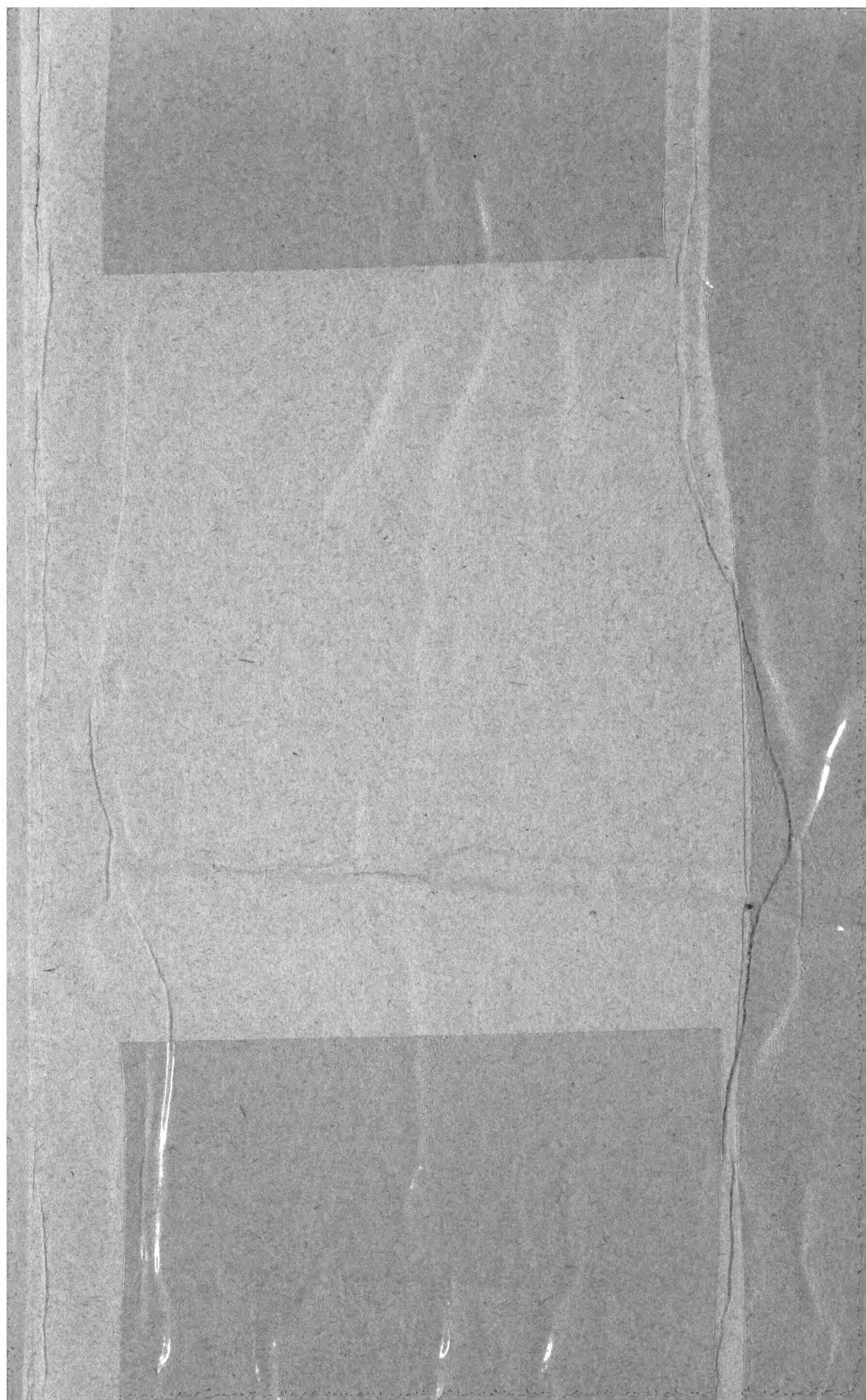
wide, the level of which is about the division between the drift and the overlying stratified deposits. From it a thin creamy mud trickles down the lower part of the bank, and this may be due either to the thawing out of frost in the top of the bank or to the surface-water flowing out at the contact of the impervious drift. The high banks are sometimes marked by small land slides or mud-streams, which, starting from the top, run to the bottom, in a uniform groove, the same channel serving for successive flows of mud.

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SC  
551: (\*426)  
BELL

BELL, Robert  
Report on the country between  
Lake Winnipeg and Hudson's Bay,  
1878

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